PATENT SPECIFICATION

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International Classification:—G 05 d (B 29 h, B 65 g, h).

COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Improvements in or relating to Feeding Devices

We, DUNLOP RUBBER COMPANY LIMITED, a British Company of 1, Albany Street, London, N.W.1, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to feeding devices for maintaining lengths of material along a predetermined course. The invention is more particularly concerned with tread centralising devices for centralising lengths of tread material as they are fed onto a tyre building former.

In known supply apparatus by means of which a length of tread material is fed onto the former of a tyre building machine, it is very difficult to ensure that the tread is positioned symmetrically with respect to the mid-circumferential plane of the former while it is being wrapped around the former.

According to the present invention a device for feeding and maintaining a length of material along a predetermined course comprises a support for a length of material, a position locating means incorporating material contacting means for detecting any transverse displacement of a portion of the material between its edges from a predetermined fixed course of a length of material passing the device, means for moving said length of material in a transverse direction, and an electrical control system operated by the position locating means for actuating the means for moving the length of material transversely to correct any transverse displacement thereof from its predetermined course.

With such an apparatus a length, for example, of tread material can be positioned automatically symmetrically with respect to the mid-circumferential plane of a tyre building former prior to and during its assembly upon the former so eliminating any human error which is involved in manually positioning a length of tread material upon the former.

Preferably, the support for the material is a conveyor disposed with the axes of the rollers of the conveyor lying parallel to the axis of the drum.

Preferably also, the conveyor is movable transversely for moving a length of tread material disposed thereon in a transverse direction.

The tread position locating means can determine either the actual position of a length of tread material or merely any variation of its position from the predetermined fixed position, and transfer this to an electronic control circuit. Preferably, the locating means comprises a feeler pin for engagement with a longitudinal groove provided in a length of tread material, this groove extending, preferably, along the centreline of the tread. The feeler pin engages in this groove and is guided therein, while the tread moves along to the tyre building former. The lateral deviations of the pin are converted into electrical values and these are fed to the control system as measurable quantities.

In one form of the invention the control system is connected to the drum which is brought to a standstill when a length of tread material passing along the conveyor deviates from the predetermined fixed position by more than a predetermined amount. The drum is again rotated when the position of the material has been corrected.

Lengths of tread material may be stored within a tread stillage, the lengths of material being arranged in layers with a sheet of interleaving material placed in between adjacent layers. Each separate length of material is carried onto a conveyor by withdrawing the underlying sheet of inter-

[Price 4s. 6d.]

leaving material, the length of material being adjusted transversely by means of a device according to the invention to position it symmetrically with respect to a tyre building former.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings in which:—

Figure 1 is a side elevational view of a tyre building drum, conveyor and tread centralising device;

Figure 2 is a plan view of the apparatus shown in Figure 1;

Figure 3 is a view in the direction of arrow '3' in Figure 1;

Figure 4 is a side elevational view on a larger scale of the tread centralising device shown in Figures 1-3;

Figure 5 is a plan view of the tread centralising device shown in Figure 4, showing in dotted outline the position of the mechanism of the device for a lateral movement of the feeler pin;

Figure 6 is a view on section "6-6" on Figure 4;

Figure 7 illustrates a second embodiment of the invention and is a side elevational view of a tread centralising device and conveyor mounted on a tread stillage, showing a length of tread material being removed from the stillage onto a tyre building former;

Figure 8 is a circuit diagram of one form of control system for use with the apparatus shown in Figure 7.

As shown in Figures 1 to 3, one embodiment of the invention comprises a conveyor 30 for feeding lengths of tread material to a tyre building former. The conveyor comprises a U-shaped frame 30*a* in which a plurality of rollers 31 are rotatably mounted at their ends, the rollers lying in parallel relationship. The conveyor 30 is supported on a base frame 34 by means of two screw-threaded guide shafts 33 in screw-threaded engagement with internally screw-threaded members secured to the framework, the two shafts being rotatably mounted at their ends in bearings provided in the base frame 34, so that upon rotation of the shafts in the appropriate direction the conveyor may be moved bodily transversely upon the screw threads in either direction as shown by arrow 48 in Figure 3. The two shafts are drivably connected to an electric motor *m*2 for rotating the shafts with respect to the internally screw-threaded members, by means of an endless chain 36 passing around two sprockets 38 and 39 provided, respectively, one on the driving shaft of the motor and the other on one of the shafts, and by another endless chain 37 passing around sprockets 39*a* and 40 provided one on each of the shafts. This driving mechanism, therefore, provides means for moving the conveyor, and thus a length of tread material positioned thereon, in a transverse direction.

Two stirrup members 45 and 47 pass transversely across the conveyor 30 and are secured by their ends to the base frame 34. A tread position locating means 42 is supported by the member 47 in a position above the conveyor 30. As shown in Figures 4 and 5, the locating means 42 incorporates a material contacting means comprising an arm 73 pivotally mounted about a vertical axis 74 within a box 65 from which one end 73*a* of the arm projects. The end 73*a* of the arm is fork-shaped, and between the ends of the fork a finger 71 is pivotally mounted about a horizontal axis 72. A feeler pin 70 is provided at the other end of the finger 71 and extends from the finger towards the conveyor 30. The other end of the arm 73 is provided with a pin 75 which is received in a longitudinal groove 76 formed in one end of an arm 77, pivotally mounted intermediate its ends about a vertical axis 79 upon a supporting member 66. An arcuate member 78, the centre of radius of which coincides with the axis 79, extends from the other end of the member 77.

As shown in Figure 5, the pin 70 lies in its neutral position and transverse movement of the pin 70, therefore, in either direction from that position, pivots the arm 73 about the axis 74, thereby causing the arm 77 to pivot about the axis 79. A pair of photo-electric cells 62 are positioned on a support 64 within the box 65 and are disposed just clear of the ends 50 and 61 of the arcuate member 78 when the pin 70 is in its neutral position, so that light from light sources 63 to the cells 62 is not interrupted. Upon movement of the pin 70, however, from the neutral position by reason of the transverse displacement of a length of tread material passing the pin, as will be described, the member 78 passes across one of the cells 62 and obscures the light passing to that cell from the light source. Such a movement of the mechanism is shown in dotted lines in Figure 5. The pair of cells 62 are connected in an electrical circuit to operate the motor *m*2, and upon light to one of the cells becoming obscured, the motor is actuated to move the conveyor 30 in a transverse direction by means of the spindles 33, as has already been described, to adjust the position of the material, thus returing the pin 70 to its neutral position.

The stirrup member 45 supports a plurality of rollers 46 upon a bracket 45*a* above the conveyor 30. The rollers are disposed in two groups, the two groups being positioned symmetrically one on each side of the neutral position of the pin 70 with the rollers in each group lying in side-by-side relationship with their axes parallel. The

member 45 is normally held in its uppermost position by spring means (not shown), but during movement of tread material along the conveyor it is raised away from the conveyor by an electrical means (also not shown).

In use the tread centralising device is positioned adjacent to a tyre building former 44, as shown in Figures 1 to 3, with the rollers 31 of the conveyor disposed with their axes parallel to the axis of the former and with the neutral position of the pin 70 in alignment with the mid-circumferential plane of the former. The former is driven by an electric motor *m*3 which is connected in the electrical circuit with the motor *m*2 and the the motor *m*3 is actuated to drive the former only when the pin 70 is positioned within predetermined narrow limits on either side of the neutral position.

A length 41 of tread material, provided in its upper surface with a groove 49 which extends along the longitudinal axis of the tread material, is passed along the conveyor, as shown in Figures 1 and 2, beneath the pin 70 which is located within the groove 49 (see Figure 6), and towards the former. If the length of material is so disposed upon the conveyor that the pin 70 is held by the material within the predetermined limits on either side of its neutral position, the light passing to the cells 62 is unobscured. The motor *m*3 is actuated for rotating the former, and the rollers 46 on the stirrup member 45 are held in contact with the upper surface of the length of material to guide it onto the former with the length of material disposed symmetrically with respect to the mid-circumferential plane of the former. If, however, the length of material moves transversely across the conveyor, thus moving the pin 70 out of its predetermined limits, the light to one of the cells 62 becomes obscured, and the motor *m*2 is actuated to move the conveyor 30 to adjust the position of the tread and return the pin 70 to a position within its limits. Simultaneously with the actuation of the motor *m*2 the motor *m*3 is de-energised to stop rotation of the former 44 and the rollers 46 are raised out of contact with the length of material. After adjustment of the length of material and the pin 70, the motor *m*2 is de-energised, the wheels 46 are lowered into contact with the material, and the motor *m*3 is again actuated to drive the former. The length of tread material is thus positioned around the former symmetrically with respect to the mid-circumferential plane of the former.

In a second embodiment according to the invention, a tread stillage unit 86 comprises a tread stillage 85 having a conveyor 85*b* mounted thereupon. The tread stillage 85 is mounted upon a frame 85*c* which is movable upon wheels 87 into and out of an operating position in which it may feed lengths 41 of tread material onto a tyre building former 44*a* which is drivable by means of a motor *m*5.

The stillage 85 and conveyor 85*b* are movable transversely upon the frame 85*c* upon screw-threaded shafts 85*d* by means of an electric motor *m*4 in a similar manner to the conveyor 30 of the first embodiment.

Interleaving material 88 made from polyvinyl chloride is wound onto and off a spool 90, rotatably mounted upon the framework of the stillage 85 the spool 90 being drivable by a motor *m*1 for feeding the material 88 over roller 89 and onto the stillage, for positioning the material 88 between lengths of tread material arranged in layers inside the stillage, and for rewinding the material 88 back onto the drum. A tread position locating means 42 of similar construction to that described in the first embodiment is mounted across the conveyor 85*b* upon vertical supports 85*e* secured to the frame 85*c*.

The electrical control system for operating the apparatus will now be described with reference to Figure 13.

Figure 8 shows the complete electrical circuit diagram of the control circuit. In it the photo-electric cells 62 are designated by *f*.1 and f.2 respectively, where, for example, *f*.1 is a photo-resistance situated on the left of the tread, and *f*.2 is a photo-resistance situated on the right of the tread. In the supply circuit a cut-out unit *e*.1 and a main switch *a*.1 are provided in the circuit section 51 in the alternating current part. In the alternating current part, in circuit sections 54-60, the winding motor *m*.1 for the tread supply, the regulating motor *m*4 for moving the conveyor, and the drive motor *m*5 for the building machine are connected. The motors *m*1 and *m*4 have a reverse rotation device consisting, respectively, of switches C.1 and C.2, and C.3 and C.4. while *m*5 is directly connected in circuit through the switch C.5. The operating units for the cut-outs *e*.3 and *e*.4 of motors *m*1 and *m*4, respectively, are in the circuit sections 15 and 18 of the switches C.1, C.2, C.3, C.4. The operating current for the switches, and the remaining circuit is taken from an alternating current supply, through a cut-out *e*.2 and a hand-operated switch *b*.1. The direct current necessary for two gas-discharge tubes P.1 and P.2 in circuit sections 8 and 12, is taken from a secondary winding of transformer *m*.4 and a rectifier *n*.1. A further secondary winding of the transformer *m*.4 acts as the feed for lamps 63, which are designated as *h*.2 and *h*.3, in circuit sections 3 and 4. To these lamps are connected adjustable resistances *r*.1 and *r*.2 for adjusting the lamp current. An indicator lamp *h*.1 in current section 1 shows when the circuit is made. The operating unit for lowering the rollers 46 towards the conveyor

is in circuit 20 and is connected in series with contacts *d*.1 and *d*.2 and in parallel with an indicator lamp *h*.4. The contacts *d*.1 and *d*.2 remain closed while the former motor *m*.5 is energised.

The winding motor *m*1 may be switched on by hand, by hand switches *b*.2 or *b*.3 in the circuit sections 14, 15 and 16. The motor *m*.1 can also be actuated automatically by means of the timing device *u*.1 of the machine, as the timing device actuates a relay *d*.4 in the current section 23, the moving contact of which lies in parallel with the switch *b*.2. For the operation of the adjusting drive motor *m*.4, a moving contact of an auxiliary relay *d*.3 is provided in the current section 18, which is regulated by means of a timing device *u*.1 in the current section 13. The timing device *u*.1 also operates in the current section 21 of the switch C.5 of the tyre building machine motor *m*.5. The motor *m*.5 may be de-energised manually by releasing a foot switch *b*.6 or trip switch *b*.7. The winding motor for the tread store, the regulating motor, and the drum are also coupled by means of the timing device *u*.1. The auxiliary or ignition anodes of the discharge tubes P.1 and P.2 are connected, respectively, by means of voltage dividers *r*.3 and *r*.4 to the direct voltage supply. When the photo resistances *f*.1 and *f*.2 are subjected to light, their resistance is small and, accordingly, the auxiliary anode is without any voltage. In this case no anode current flows through the relay *d*.1 or *d*.2 in the anode circuit of the tubes.

To load a tread stillage 85 with tread material the motor *m*1 is actuated by means of the hand switch *b*.3 to unwind the interleaving material from the spool 90 and position it between adjacent lengths 41 of tread material as they are positioned within the stillage. The control circuit is then energised, foot switch *b*.6 is pressed to energise motor *m*5 to rotate the former, and switch *b*.2 is closed by the relay *d*.4 to rewind the interleaving material onto spool 90 thus moving the uppermost length 41 of tread material onto the conveyor 85*b*. the wheels 46 being lowered into contact with the length of material. If the length of material is not correctly disposed with respect to the locating means 42 the light to one of the photo-electric cells, for instance *f*.1, becames obscured as described in the first embodiment. Consequently, the potential at the auxiliary anode of the tube P.1 increases so much that it fires. An anode current flows, passes through the main anode and the anode current relay *d*.1, and closes the contacts *d*.1 in section 17 thus completing the circuit in section 17, whereby the current flows through the switch C.3 energising the motor *m*4 to move the stillage unit 86 in the appropriate direction to correct the displacement of the length of tread material and the pin 70. Simultaneously with the completion of circuit section 17, contacts *d*.1 in sections 20 and 21 are opened to allow the wheels 46 to be raised by the spring means and open switch C.5. to de-energise motor *m*5 during the movement of the stillage unit 86, and the switch *b*.2 in section 14 is opened to de-energise motor *m*1 and stop the rewinding of interleaving material onto the spool 90. As soon as the tread material and pin 70 are again correctly positioned with respect to the locating means 42, the resistance in *f*.1 drops, the condenser K.3 switches off the current and the anode current in relay *d*.1 is interrupted. The contacts *d*.1 in section 17 are reopened to open switch C.3 whereby the motor *m*4 is brought to a standstill, and contacts *d*.1 in sections 20 and 21, and switch *b*.2 in section 14 are closed to lower the wheels 46 into contact with the length of material and to energise motors *m*5 and *m*1, respectively, to feed the length of tread material towards and onto the drum and to rotate the drum. Similarly, if the other photo-electric cell *f*.2 is obscured the same procedure is followed, this being effected by the relay *d*.2 in current section 12 operating contacts *d*.2 in sections 19, 20 and 21 and switch *b*.2 in section 14.

WHAT WE CLAIM IS:—

1. A device for feeding and maintaining a length of material along a predetermined course comprising a support for a length of material, a position locating means incorporating material contacting means for detecting any transverse displacement of a portion of the material between its edges from a predetermined fixed course of a length of material passing the device, means for moving said length of material in a transverse direction, and an electrical control system operated by the position locating means for actuating the means for moving the length of material transversely to correct any transverse displacement thereof from its predetermined course.

2. A device according to claim 1 wherein the support is a conveyor.

3. A device according to either of claims 1 or 2 wherein the position locating means comprises a photo-electric cell unit, and the material contacting means comprises an arm pivotally mounted about an axis which is stationary with respect to the predetermined fixed position, a feeler pin for engagement with a groove provided in the length of material and operably connected to the said arm to pivot the arm upon movement by the groove of the pin, the pivotal position of the arm controlling the operation of the photo-electric cell unit.

4. A device according to claim 3 wherein a pair of photo-electric cell units is provided one on each side of the said arm, in a posi-

tion such that light to one or other of the cells of the said units is obstructed by pivotal movement of the arm in either direction, said units each being connected to the electrical control system.

5. A device according to any of the preceding claims wherein the means for moving the conveyor in a transverse direction comprises a framework upon which the conveyor is mounted and a rotatably mounted shaft having a screw-thread formed thereon in screw-threaded engagement with an internally screw-threaded member connected to the framework and an electric motor drivably connected to the said screw-threaded shaft and internally screw-threaded member to rotate one with respect to the other and transversely move the conveyor.

6. A device according to any of the preceding claims wherein guide means are provided for guiding a length of material in the form of a tread strip from the conveyor onto a tyre building drum.

7. A device according to claim 6 wherein the guide means comprises a plurality of rollers mounted above the conveyor with the rollers positioned on each side of and symmetrically with respect to the predetermined fixed position, said rollers being movable towards and away from the carrying surface of the conveyor.

8. A device according to any of the preceding claims wherein the electrical control system in conjunction with a tyre building machine having a building former and a motor for driving the former operates to control the former driving motor to rotate the former when a length of material is in its predetermined fixed position and to stop the former upon displacement of the length of material from that postiion.

9. A tread centralising device constructed and arranged substantially as described herein and shown in Figures 1 to 6 of the accompanying drawings.

10. A tread centralising device constructed and arranged substantially as described herein and shown in Figures 7 and 8 of the accompanying drawings.

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Agent for the Applicants.

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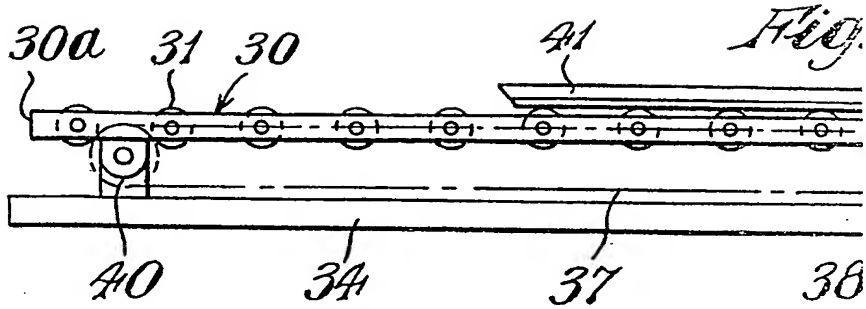

Fig.

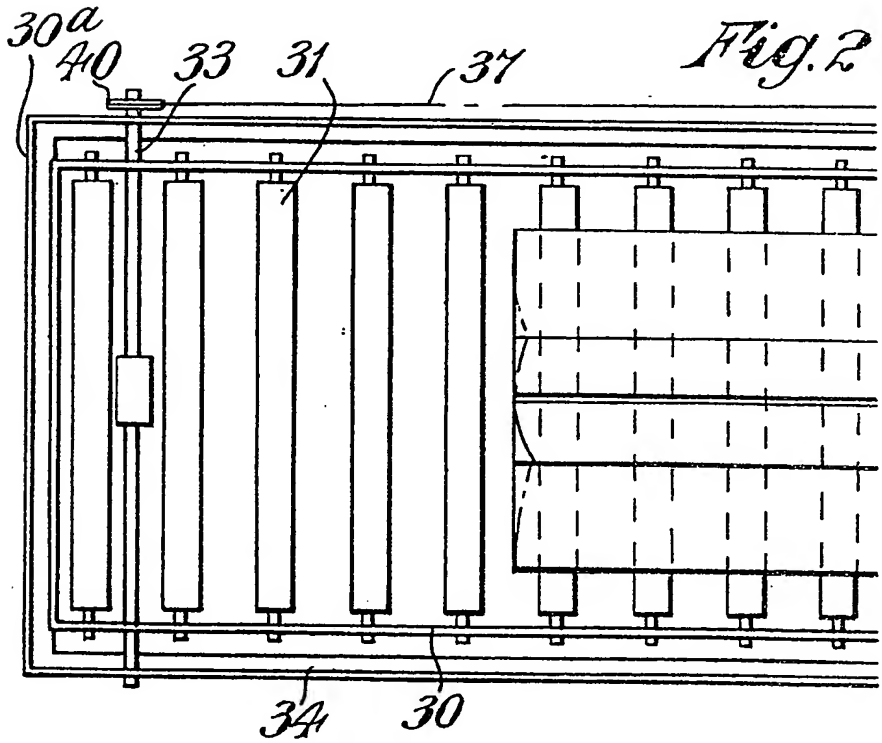

Fig. 2

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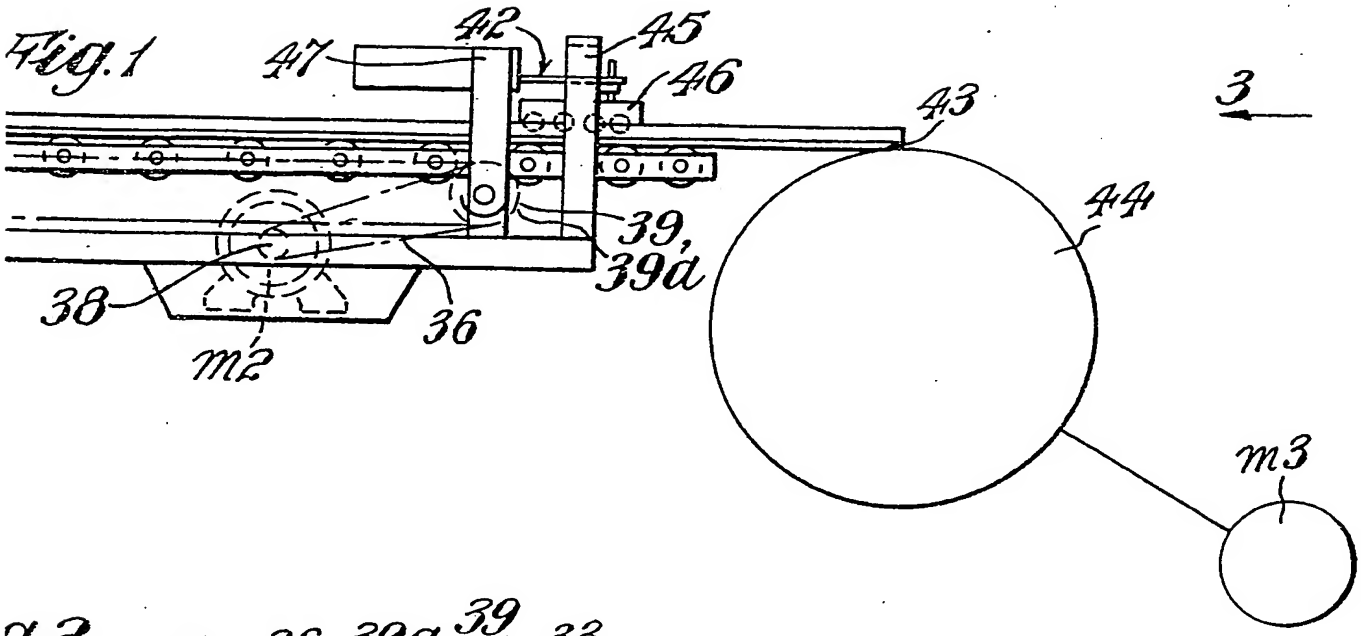

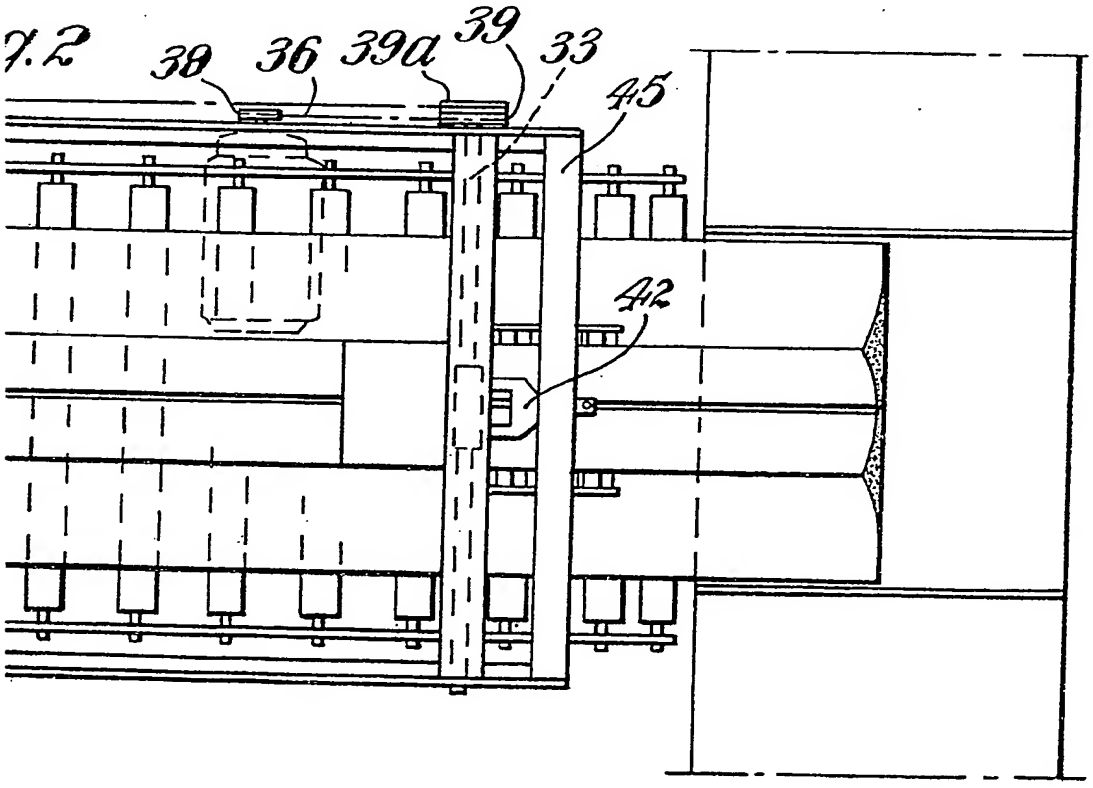

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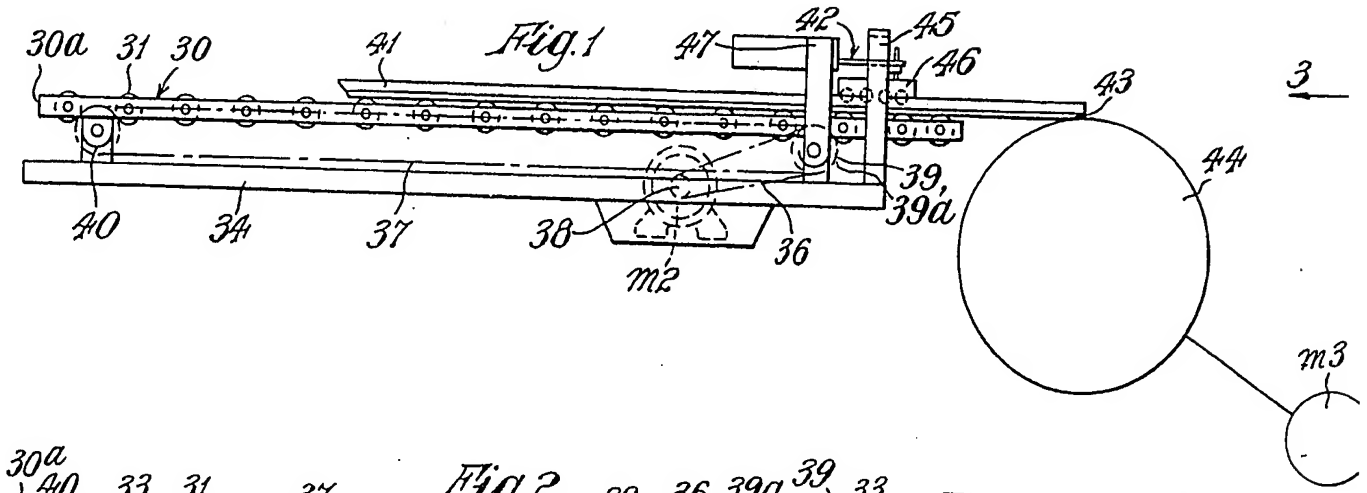
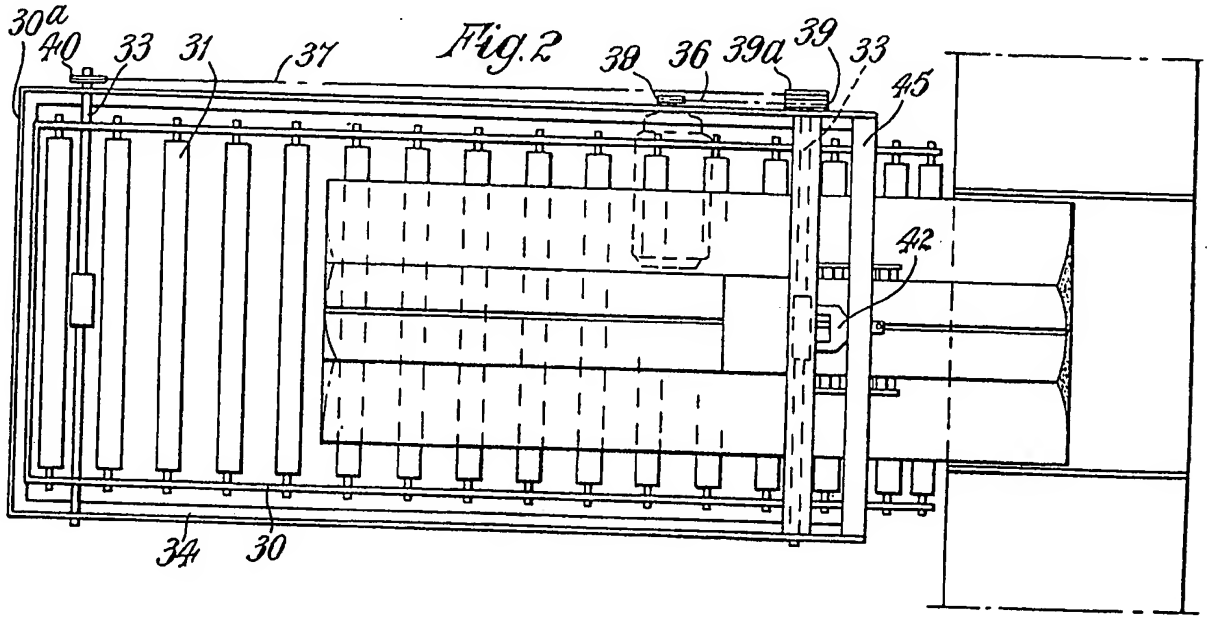


Fig. 1



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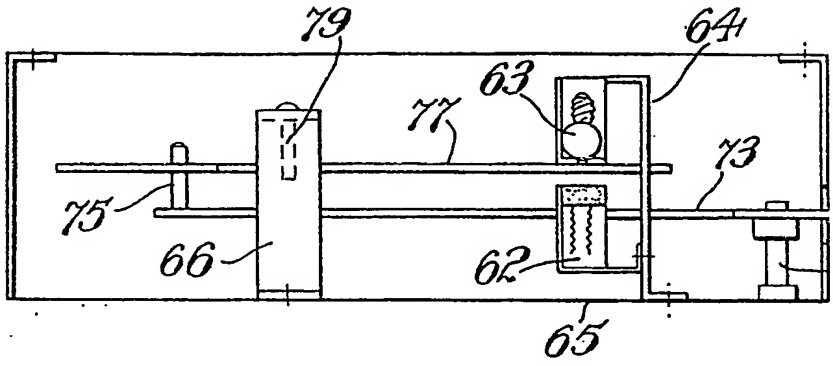
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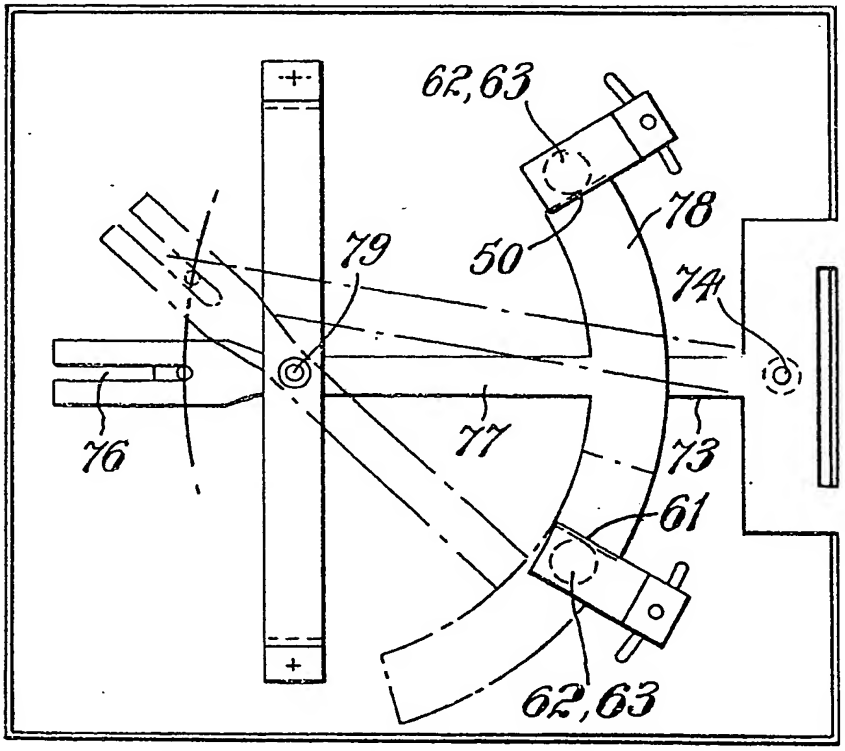
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Fig.3

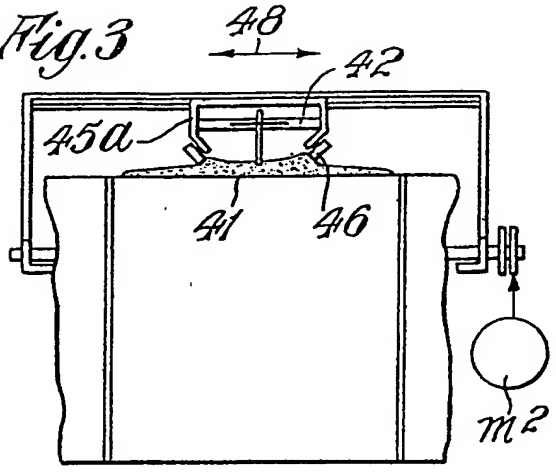


Fig.4

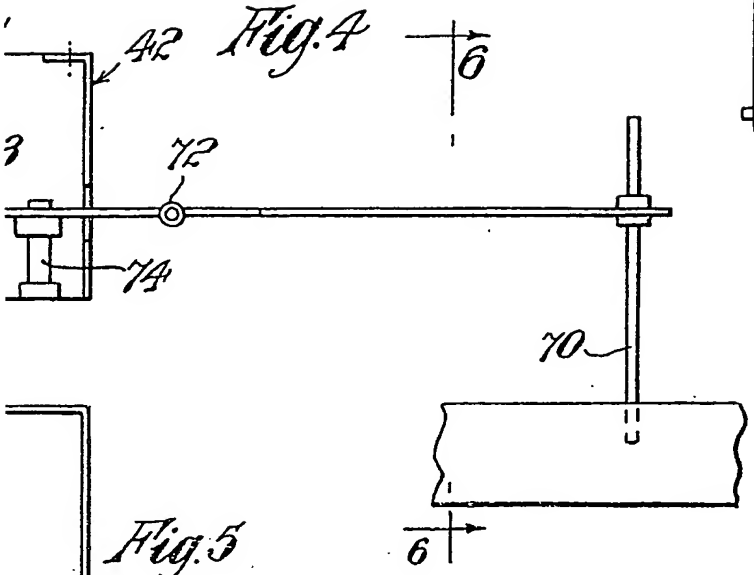


Fig.5

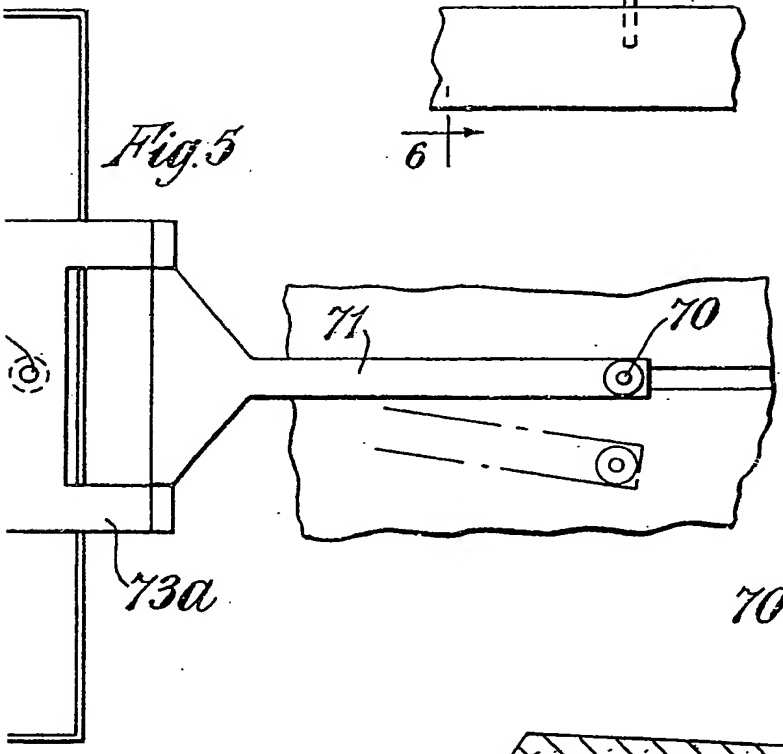
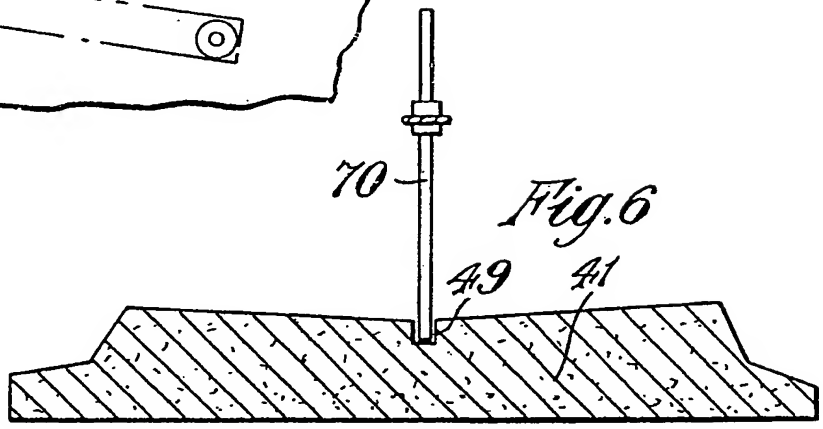


Fig.6



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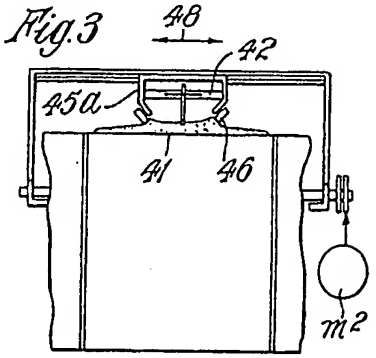


Fig.4

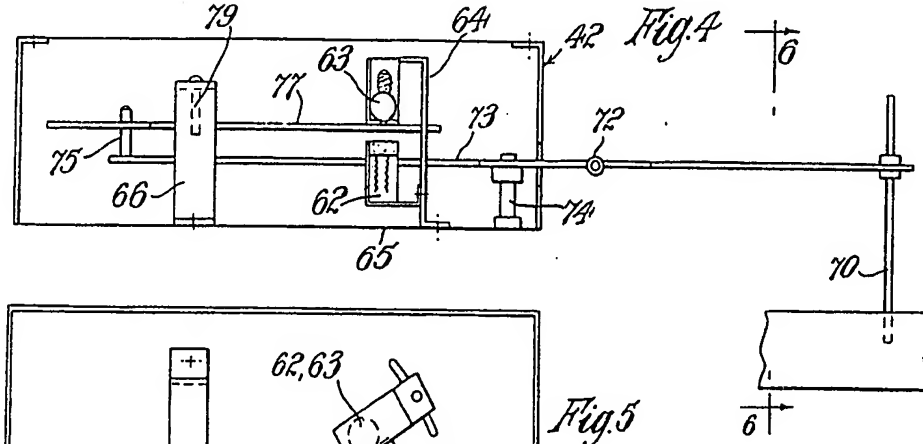


Fig.5

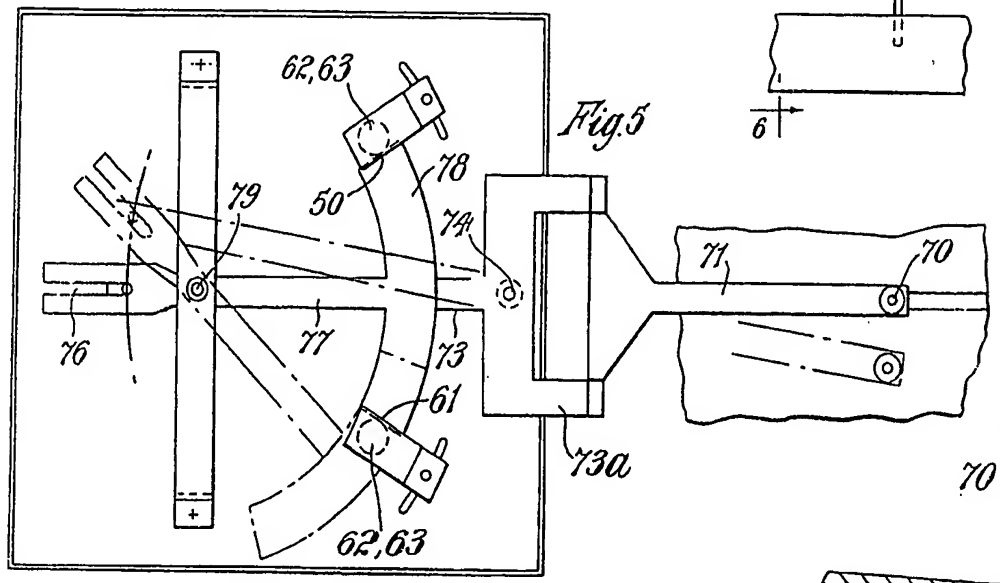


Fig.6

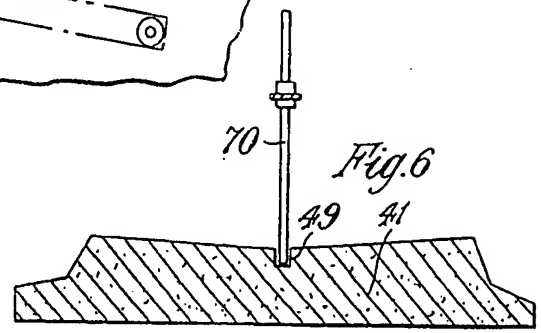
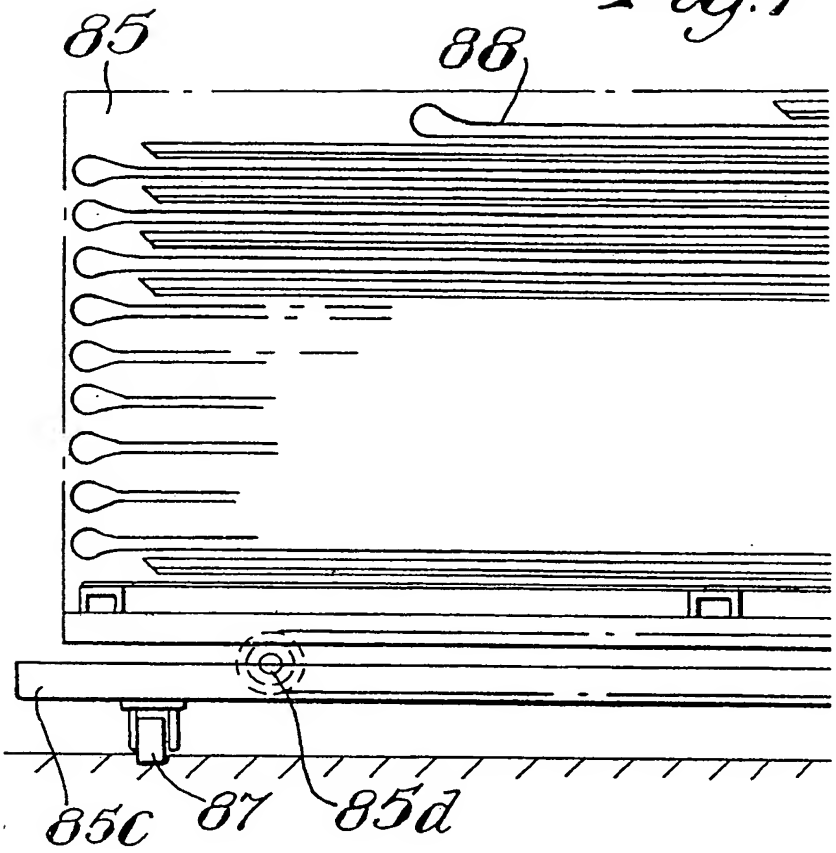


Fig. 7



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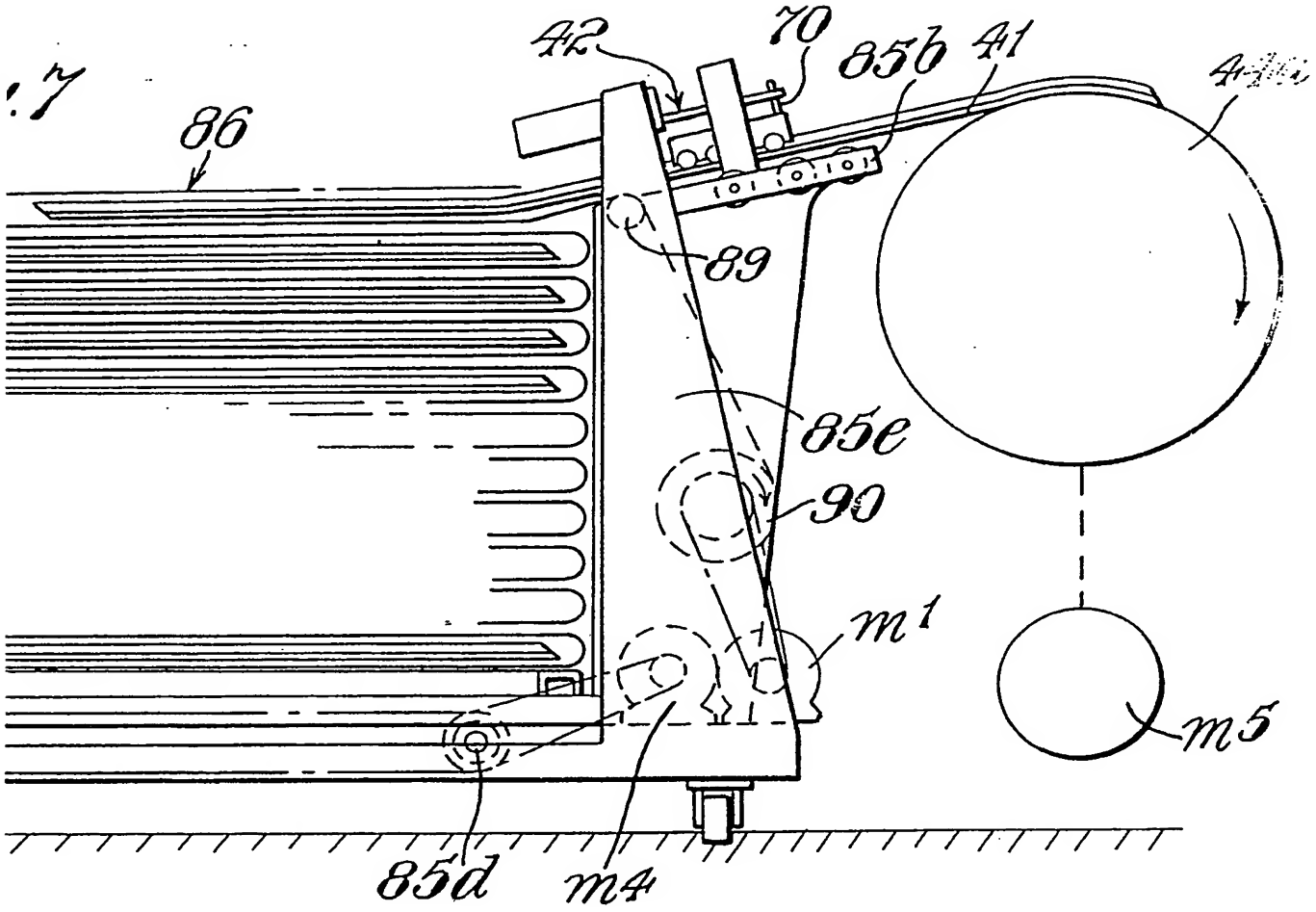

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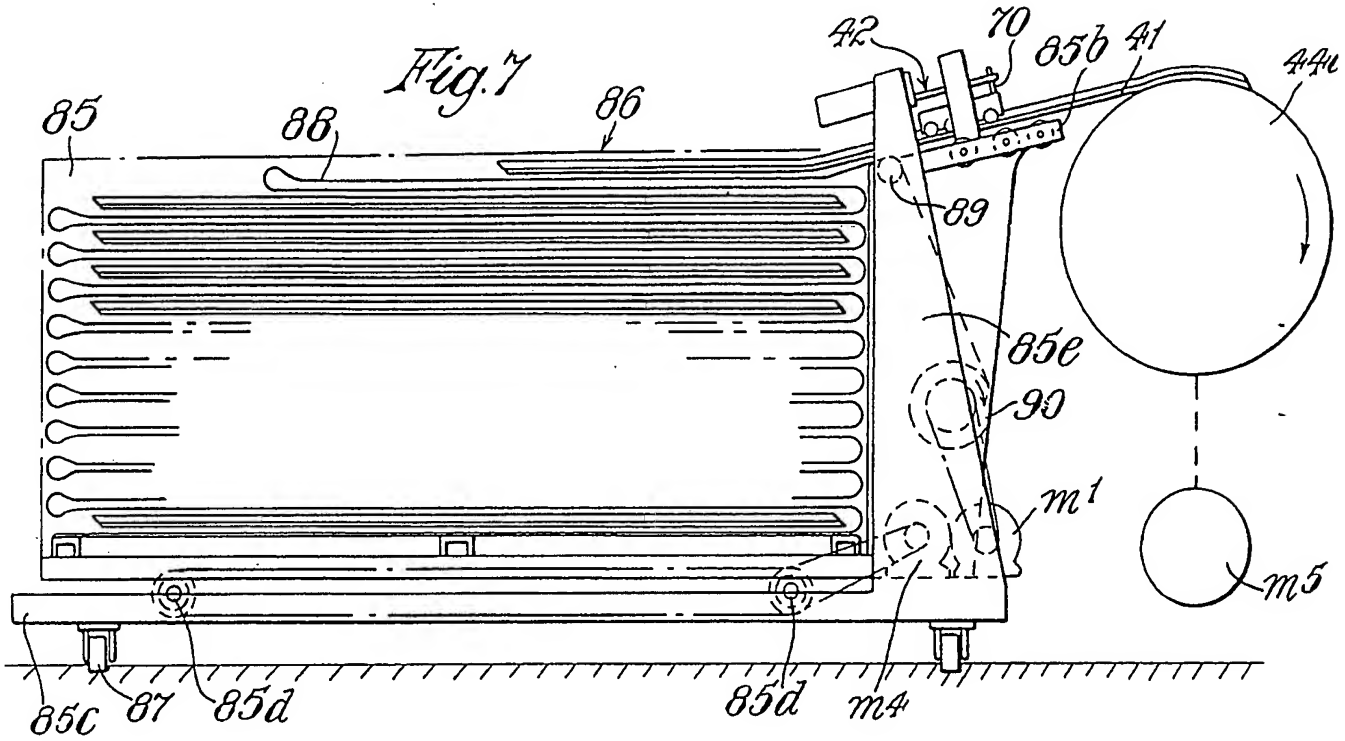
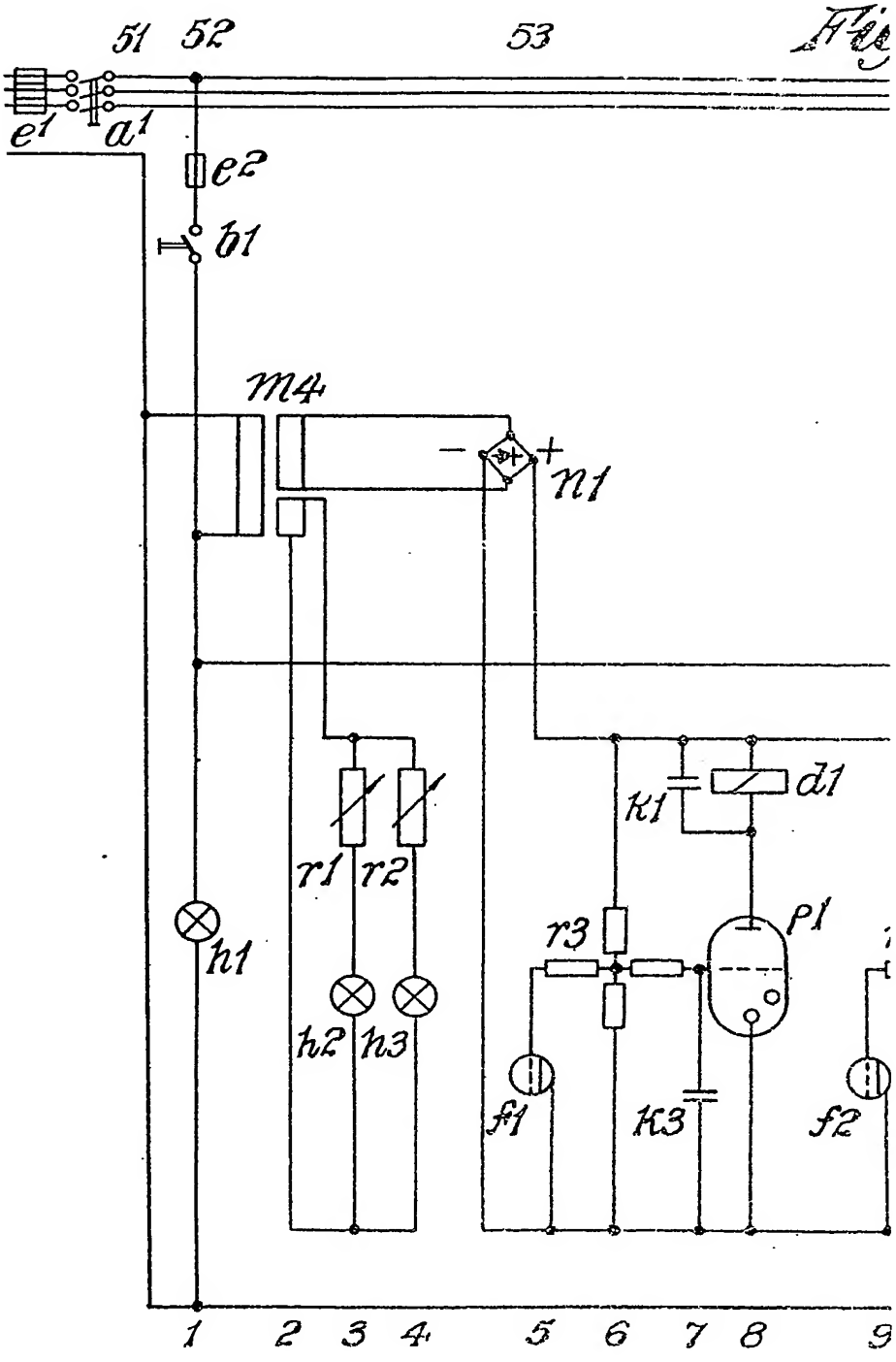
Fig. 7

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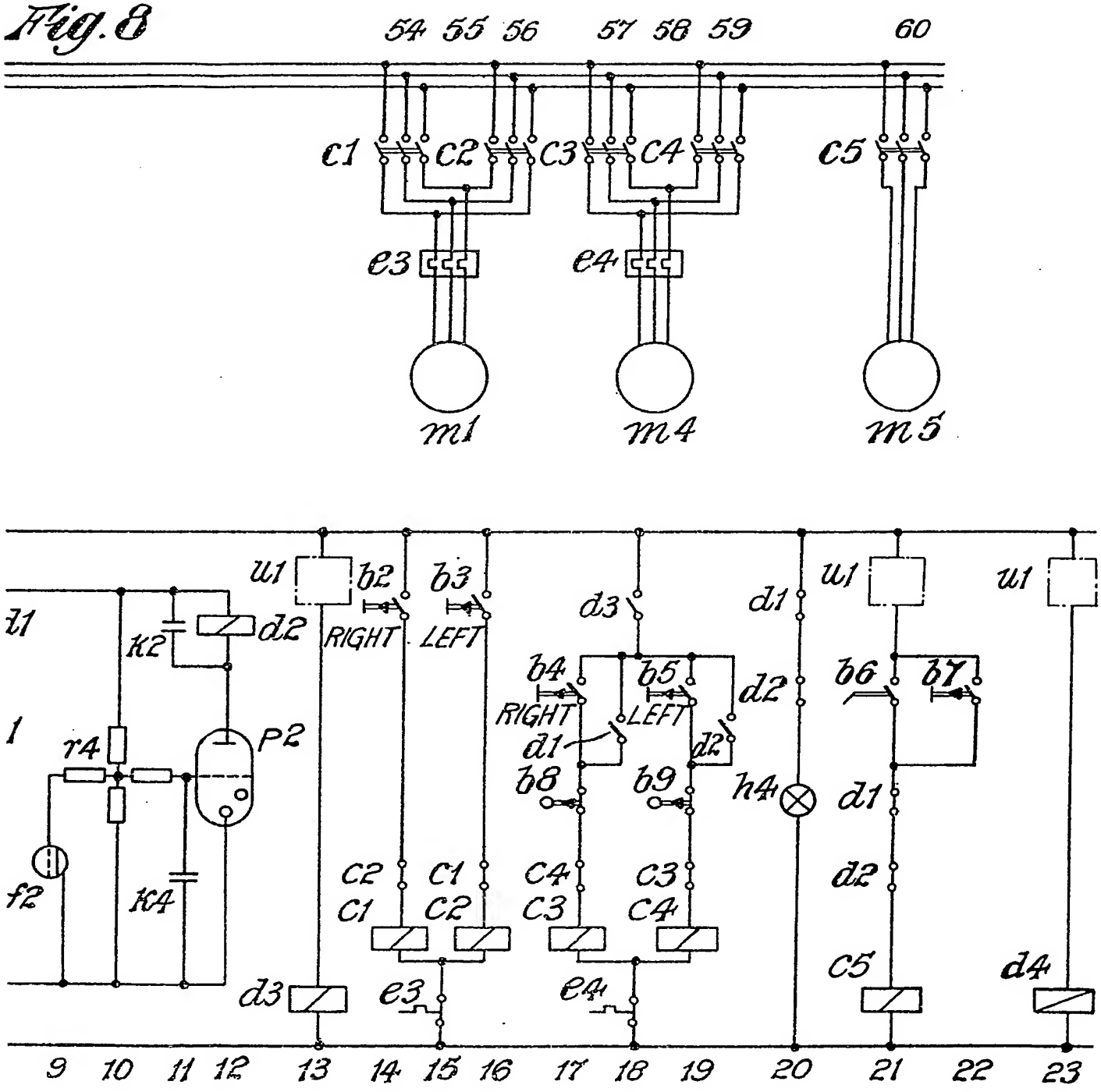
SHEET 4

Fig. 8



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4 SHEETS

COMPLETE SPECIFIC/

SHEET 4

Fig. 8